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Coffee Bean, Coca Leaf, and Crime in Colombia

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By

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Abstract

In this paper, I am using panel data of merged datasets that include coffee bean hectares of cultivation, coca leaf cultivation, massacres, and selective assassinations to study the relationship between coffee bean production and the level of homicide rates in Colombia during 2002-2010. This is a departmental level analysis across six coffee-growing departments: Antioquia, Caldas, Cauca, Huila, Tolima, and Cauca Valley. I use a fixed effect regression model to analyze the relationship between coffee bean production, coca leaf production and the two types of homicides. My results do not show a direct link between coffee bean production and levels of homicides reported. However, there is a significant negative correlation between the dummy year variables and both types of homicides. Thus, demonstrating that other factors had a significant influence on the reduction of homicides across the 8 years, such as the election of a new president and the establishment of international coffee prices. Moreover, the results also show that encouraging farmers to cultivate an alternative crop is not always enough to completely halt the cultivation of coca crops. Most of the literature on coffee bean production and crime rate, studies general crime in Colombia during one period of time or before the years 2000. My study adds to the current literature by analyzing the effect of coffee bean cultivation on specific crimes, massacres and selective assassinations, across the years 2002-2010.

I. Introduction

A never-ending war between drugs and poverty in Colombia has plagued the lives of many rural farmers who have dedicated their livelihood to cultivating coffee beans. The war on illicit drugs has invited foreign aid to try to stop the cultivation of these product. Historically, the cultivation of coffee beans and coca crop were two of the leading exports in Colombia.[1] The coffee bean crop is major agricultural export that provides high employment to many rural Colombian households.[2] Additionally, coffee bean and coca leafs cultivation in similar environments. Both crops require certain components in order to thrive such as high altitudes, moderate temperatures, rainfall, humidity, and volcanic soil.[3] Nevertheless, with the rise of armed organizations and government conflicts, one product became more financially attractive than the other.

The relationship between coffee bean cultivation and crime rates in Colombia is a topic that Colombian scholars have researched in depth; however, they have focused on general crime rates and not specific crimes. The purpose of this paper is to analyze the effects of coffee bean cultivation on homicidal crime rates on a departmental level analysis in Colombia. In order to understand the relationship between coffee beans and crime, one must first understand the connection between coffee bean cultivation and coca leaf cultivation. In addition, one must also understand the connection between coca leaves and crime to understand the overall link between coffee bean farmers and violence in Colombia. The overall question I seek to answer is whether or not coffee bean production has a significant effect on rates of homicide within Colombia.

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[1] Dube & Varga, 2006; United Nations Office on Drugs and Crime, 2006
[2] Federación Nacional De Cafeteros, 2010; Andrade et al., 2013
[3] Andrade et al., 2013; Nuestras Regiones cafeteras, 2011; United Nations Office on Drugs and Crime, 2006

Colombia is the second largest coffee bean producer in Latin America and one of the largest producers of coffee beans in the world. The high production of coffee beans might also explain the high levels of crime within the country. Foreign military aid from the United States to Colombia has amounted to over 9 billion dollars since 2000 (Plan Colombia, n.d). The U.S. joined forces with the Colombian government through an international policy called Plan Colombia to alleviate human rights violations and end drug-trafficking through military means (Plan Colombia, n.d.). Many scholars, policy officials, and activist have criticized the effectiveness of the overall program, and many wish to end the policy because it has not accomplished what it had promised to do (U.S. Policy in Colombia, n.d.). As the U.S. continues to pour aid into Colombia's drug-stricken economy, it is worth researching an alternative method that could possibly reduce the coca crop production and end the fuel to crimes.

In my study, I use datasets from the Colombian Coffee Grower's Federation and the Empirical Studies of Conflict database to collect data on coffee bean hectares of cultivation, coca leaf hectares of cultivation, massacres cases, and selective assassinations cases. I use a fixed effects regression model to analyze the relationship between coffee bean production and coca leaf production to the homicide rates over the course of 2002-2010. My overall results suggest that there is no significant correlation between coffee bean production and homicide rates, and no significant correlation between coca leaf production and homicide rates. Although my analysis does not prove a significant correlation between the agricultural products and crime, it does shed some light on the effectiveness of Plan Colombia, a policy that encourages farmers to grow an alternative crop over growing coca crops that fuels the civil conflict in Colombia. An alternative crop is not enough to halt the cultivation of coca leaf production; thus more research is needed to make Plan Colombia an effective policy.

I propose to answer my research question in 5 sections. In section 2, I will provide a brief background on Colombia's armed conflict. In section 3, I will provide a review of the literature related to my topic. Section 4 will address the methodology of my data and the results. Finally, section 5 will provide my concluding remarks and suggestions for further research.

II. Background

To understand Colombia's current issues, it is important to know about the political history that has shaped its economy. Colombia's civil conflict between armed groups and the government initiated during the period called "La Violencia",[4] and it manifested into a war that has lasted over 50 years (Paterson, 2014). This ordeal began with the assassination of a liberal presidential candidate, Jorge Eliecer Gaitan Ayala, a beloved candidate that supported the poor communities of Colombia (Paterson, 2014). During this period, a violent outbreak separated a country between liberals, conservatives, and communists. In the midst of the outbreak, poor rural farmers joined small groups in order to protect their lands against those who imposed on them. The presence of communism in Colombia put the U.S. on edge; therefore, any political party that was not liberal or conservative was automatically considered communist by both governments (Paterson, 2014).

Marxist ideologies formed the foundation for the uprising of peasant farmers, also known as the guerilla, thus they armed themselves with weapons and became mobile in order to protect their livelihood against opposing forces (Paterson, 2014). These opposing forces, also known as the paramilitary groups, became defendants of large landowners, drug traffickers, and businessmen. In order for these two groups to thrive and continue their operations, they sought

[4] Spanish for The Violence

out diverse sources of income, many of which included criminal activity such as kidnappings, murders, bombings, extortion, and drug-trafficking (Paterson, 2014). What once started as a peasant farmer movement evolved into civil war between armed groups and the Colombian government.

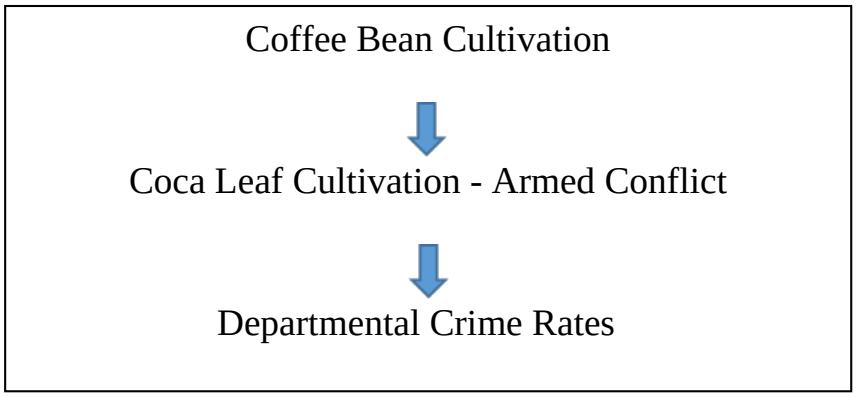
The trafficking of drugs from Latin America to the western world became the main source of income for those involved with the trade (Holmes et al., 2006). During the 80's, cocaine became extremely popular in the U.S., and because coca leaves are the main ingredient in producing cocaine, it provided economic incentives for farmers to cultivate high quantities of it (Paterson, 2014). Nevertheless, the U.S. pressured the Colombian government to eradicate the cultivation of coca leaves. Eradicating a traditional native crop resulted in a backlash from many rural communities. Coca leaves have a historical presence in the Andean region, mainly because it is an important part of the indigenous tribe's daily diet (History of the Coca Plant, n.d). As the Colombian government initiated eradication actions throughout the country, with the help of the U.S., coca leaf became an illegal product to cultivate (Miroff, 2015).

As the conflicts continued, many families were forced to migrate away from their homes while others joined the movement to avoid conflict. The drug trade fueled many of the armed groups operations. Holmes et al. (2006) quotes that the power of guerilla groups is linked with the control of the drug market. Furthermore, Rangel (1998) (as cited in Holmes et al., 2006) states that more than half of FARC's income is funded through drug operations and one third of their members are dedicated to coca related activities.[5] Many of these armed groups are involved with the homicides that occur in Colombia. In the following literature review, I will explain how their violent presences has affected Colombia's overall agricultural economy.

[5] The Revolutionary Armed Forces of Colombia- FARC

III. Literature Review

The following literature review is structured in the following manner. I will begin by discussing the relationship between coffee bean cultivation and coca leaf cultivation. After, I will discuss the relationship between coca leaf cultivation and crime rate. Lastly, I will discuss the literature review in regards to the overall connection between coffee bean production and homicide rate. The table below visually shows the flow between the three categories.



A. Coffee Bean-Coca Crops

Garcia-Yi (2014) analyzes certified organic coffee bean production as an alternative development policy to reduce coca leaf cultivation in Peru. In the study, she clarifies that coffee bean crops are a perfect substitute to coca leaf crops, thus she surveys the district of San Pedro de Putina Punco located in the upper Tambopata valley, where the land is high in altitude and rich in precipitation and sunlight. This is a unique location that she samples because the local farmers cultivate both coffee bean and coca leaf as sources of income. The purpose of her survey is to find out how effective an organic coffee certified program is in order to curve the cultivation of coca bushes, per household (Garcia-Yi, 2014). The results demonstrate that certified organic coffee had a significant negative effect on coca leaf production; however, only farmers with large hectares of land, higher plots in altitude, farming experience, and with leveled

terrain are more likely to partake in certified coffee programs (Garcia-Yi, 2014). The farmers without these specific qualities are at a disadvantage since growing organic coffee requires experience, time, and land as demonstrated through this study. Yet, the reward for cultivating organic coffee is highly based on its retail price.

Certified organic coffee bean has a retail price based on its quality; therefore, the farmer has a high bargaining power over the product. Certified organic coffee has a price premium of about 16 percent above the market price, thus making organic coffee bean cultivation more attractive to the small-scale farmers that can afford the cost of producing organically (Garcia-Yi, 2014). In order to have organic coffee certification, the farmer must first go through a three-year process of cleaning his soil from pesticide and other chemicals used on the soil for cultivation (Garcia-Yi, 2014). Thus, the farmers who can afford to go through the process and pay the certification fee will have a comparative advantage over those who cannot. As a result, Garcia-Yi (2014) suggests that an increase in income will influence a farmer to cultivate more certified coffee beans and fewer coca leaves.

Garcia-Yi (2014) focuses primarily on organic coffee cultivation, and this is a limitation to my study because Colombia cultivates non-organic coffee beans. The Colombian Coffee Growers Federation (FedCafe) provides data on non-organic coffee beans that small scale farmers cultivate, and they pride themselves of their unique product that is cultivated on Colombian soil (Federación Nacional De Cafeteros. 2014). As a result, organic coffee beans provide the Peruvian farmer bargaining power over their harvest, while the Colombian farmer has to settle for the price that FedCafe offers. The introduction of organic coffee beans into the Colombian market, in addition to the traditional coffee bean crop, may influence farmers to cultivate more coffee beans over coca leaves.

Coca leaves also maintain a high retail price after the leaf has been processed and converted to cocaine. Miron (2003) analyzes the retail prices of cocaine on the black and legal market in the United States. Miron (2003) utilizes data from 1998 to analyze the ratios of farm gate and retail price of several legal and illegal goods. Coffee beans produced in Colombia had a retail ratio of 3-3.5 times that of the farm gate price (Miron, 2003), meaning that the farm gate price of a pound of coffee in Colombia was worth about $0.75 U.S. dollars. The retail price of roasted coffee beans in Boston was worth about $2.60 per pound (Miron, 2003). Furthermore, a cup of fresh coffee would have had a ratio of 29-34 times of the farm gate price per pound of coffee beans. Meanwhile, the farm gate price of coca leaves was priced at $0.36 - $0.57 per the required amount to produce one gram of pure cocaine, as for the retail ratio of cocaine was 262 times the farm gate prices for coca leaves (Miron, 2003). On average, the black market price for cocaine was $122 while the price for a pound of roasted coffee was only about $2.60. Miron (2003) obtained the legal price for cocaine through research and pharmaceutical companies who purchase cocaine, thus he estimates that black market prices would be similar to the legal markets prices, if not more. This means that as long as government eradication efforts continue, the retail price of cocaine will continue to increase, based on the simple supply and demand model. A shift in supply will result in higher retail market prices for cocaine. If farmers sought a source of higher income based on market prices, they would be more likely to cultivate the crop with the highest returns (Ibanez & Martinsson, 2013). Therefore, the cultivation of an alternative crop, such as coffee, must first provide sufficient profit incentive in order to reduce coca production.

Income plays a significant role when farming a certain crop because if a farmer cannot gain sufficient income to cover the cost of production, whether coffee bean is organic or not, that

farmers will search for an alternative source of income. Ibanez and Carlsson (2010) conduct a study utilizing a survey-based experiment in four municipalities of Putumayo, Colombia. Putumayo is one of the highest growing coca regions in Colombia, thus it is an ideal setting to collect information from local farmers (Ibanez & Martinsson, 2013). The purpose of Ibanez and Carlsson (2010)'s study is to determine the effectiveness of Colombia's coca eradication policy and the alternative development programs. The survey-based experiment evaluates the behavior of the farmers given a hypothetical scenario. The participants would decide how many hectares of land they would dedicate to coca cultivation based on the profit of an alternative crop and the probability of eradication. Additionally, they use a behavioral model of crime where they analyze the effects of morality, legitimacy, and social interactions (Ibanez & Carlsson, 2010).

Ibanez and Carlsson (2010) demonstrate that an increase in the profit of the alternative crop and an increase in risk of eradication will significantly decrease coca cultivation and hectares dedicated to the illicit crop (Ibanez & Carlsson, 2010). They conclude that in order for a policy to be effective, the policy has to target certain farmers based on their perceptions of coca eradication risk and profits from an alternative crop. These perceptions vary within the municipality, thus targeting the perceived risk levels of eradication and profit levels of an alternative crop can be very effective in implementing a policy that can curb coca cultivation. Ibanez and Carlsson (2010), along with Garcia-Yi (2014)'s research emphasizes the importance of profit of an alternative crop, such as coffee, in order to substitute coca crops in Latin America. An interesting observation made by Ibanez & Carlsson (2010) is that farmers with large land holdings are less likely to cultivate coca crops, but could afford to use their land to cultivate larger areas of coca crops if needed (Ibanez & Carlsson, 2010). This observation coincides with

Garcia-Yi (2014)'s observation on Peruvian farmers: the farmers with larger estates are more likely to cultivate certified organic coffee.

Although Ibanez & Carlsson (2010) focus their research on a Colombian coca growing municipality, they do not offer coffee bean crops as a hypothetical alternative crop to the farmers interviewed in their survey. Thus, if they would have included coffee bean as an option for the farmer, their results could have been different because coffee farmers have the support of FedCafe. This is one main limitation of Ibanez & Carlsson (2010)'s survey based experiment on coca growing farmers.

Finally, an observation made by Ibanez and Carlsson (2010) is farmers' sensitivity to the levels of eradication risk. Previous literature has linked negative responses to government efforts to eradicate coca crops. The government's effort to eradicate coca crops, in most cases, triggers high levels of violence in rural areas (Palacios, 2010). Therefore, to understand the overall connection between coffee bean cultivation and crime rates in Colombia, one must also understand the relationship between coca crop eradication and crime rates. In the first section of the literature review, I established that coffee beans and coca leaves are substitute crops, and that farmers are more willing to cultivate coca crops if the market price and environmental conditions are right. In the following section I will establish the link between coca crops and crime rates in Colombia.

B. Coca Crops-Crime Rate

Coca leaf cultivation is linked to armed conflict organizations that profit from the end product, cocaine (Palacios, 2010). Historically, organizations against the Colombian conservative political party have gained power and land by terrorizing small land farmers and associating themselves with drug traffickers (Holmes et al., 2006). As seen in the background

section, the relationship between armed organizations and drug traffickers is not a simple one. Armed groups either grow, process, sell, tax traffickers, or do all with the drugs manufactured (Paterson, 2014). This is why it is difficult to establish a direct link when there are many links between armed groups and drug cartels. However, Angrist and Kuglar (2008) establish that coca production and eradication perpetuates Colombia's civil conflict.

Previous literature has identified a relationship between coca leaf cultivation with the level of crime rate in Colombia. Initially, Holmes et al. (2006) state that according to the literature they analyzed, on a national level, there appears to be a positive trend between coca production and violence. However, they want to shed light on departmental figures in comparison to the overall national figure, and demonstrate that there is no correlation between coca production and human right violations in Colombia. They analyze departmental level data from 1991-2001, and they utilize four different lenses in order to determine the correlation between violence and coca production. These four lenses include: historical analysis, cartographic visualization, analytic trend in four high producing coca departments and four violent departments, and a departmental-level fixed effects model (Holmes et al., 2006). The historical analysis provides the context of government presence in Colombia's civil war. They argue that a lack of government presence in impoverished communities allowed rebel organizations to establish power roots. As a result, many citizens, rich and poor, were victims of the civil war that ripped the country apart. The cartographic visualization presents pie graphs that show the presence of coca production, internal displacement, and human rights violation on behalf of guerrilla groups, paramilitary groups, etc. on maps of Colombia (Holmes et al., 2006).

From the four lenses, it is worth focusing on the analytical trends of the eight departments. The first four departments Caqueta, Guaviare, Putumayo, Meta are known to have

high levels of coca leaf production (Holmes et al., 2006). Meanwhile the departments of Antioquia, Bolivar, Cauca, and Santander are known to have the highest rates of violence in Colombia (Holmes et al., 2006). Holmes et al. (2006) analysis reveal that coca production alone does not trigger violence in these departments, but rather violence is influenced by other variables in each department. These variables include coca eradication surfaces, human right violations on behalf of public forces (military or police officials), poverty rates, and unemployment rates (Holmes et al., 2006). These observations are then taken a step further by controlling unobservable variables in a fixed effect model. The authors utilize a panel dataset in order to analyze the change of violence rate over the three years for each department. As a result of the leftist guerilla group, the dependent variable in the regression model is human rights violation. The independent variables are homicides, displaced people, coca eradication, coca cultivation, human rights violation by public forces and paramilitaries, population, GDP growth rate, exports, poverty, and unemployment rates. The results state that levels of violence are positively correlated with government efforts to eradicate coca plots, which means that coca eradication efforts trigger violence in these eight departments, and not coca leaf production as initially stated on the national level.

Holmes et al. (2006) findings reveal the effects of coca production on the rates of violence which contributes to my overall research question. My research question includes the relationship between coca leaf hectares and homicide rates. According to their results, coca does not have a significant effect on human rights violation, which is a broad term not specified. Contrary to Holmes et al. (2006)'s model, my dependent variable will be the number of homicides dependent on coca leaf hectares of production. In their analysis, homicides stand as an

independent variable and its analysis lacks further research, henceforth I will be analyzing homicides more closely.

Further into Holmes et al. (2006)'s research, they attest that as long as the effort to eradicate coca crops persists, armed groups will continue to have a negative response towards eradication. These negative responses come in the form of assassinations, kidnappings, massacres, property damages, etc. (Centro Nacional de Memoria Histórica, 2012). Of the list of responses, I will be analyzing assassinations and massacres, further discussed in the methodology section. Holmes et al. (2006) claim that U.S. alleviating poverty policy intervention is counterproductive to Colombia's economy, and suggest that a more effective policy would be to promote a "non-traditional, labor intensive export" (Holmes et al., 2006). I agree with the statement that U.S. policy interventions is not as effective as they intended to be, thus an effective policy would be to incentivize farmers to cultivate an alternative crop, not necessarily non-traditional. As understood in Ibanez and Carlsson (2010)'s and Garcia-Yi (2014)'s research, farmers are more responsive to profit maximizing cultivation options than risk of crop eradication.

Angrist and Kuglar (2008) define coca crops as the resource curse since coca is a resource of wealth that leaves behind a trail of civil unrest and hinders economic development. In the first portion of their research, they look at various characteristics of coca growing farmers and determine that coca production increases income for males. Nevertheless, their analysis also suggest that those highly affected by the violence are young and older males. Indeed, this resource curse fuels the violence of Colombia's civil conflict, and it provides the funding for armed groups to terrorize the public. Further into their analysis, Angrist and Kuglar (2008) analyze the violent deaths in rural and urban locations of coca growing versus non coca growing

regions. In the same regions, they analyze whether or not the regions had an early presence of guerilla and paramilitary groups. This is important to their study because they predict that an early presence of either groups would influence their overall results thus they observe data between the years 1994-2000. Angrist & Kuglar (2008)'s results establish that as coca cultivation increases so does violent death rates in coca growing regions. This is significant to my own research because it makes that connection between coca production and crimes committed on behalf of armed organizations. The data I will be analyzing are violent death rates committed by guerilla and paramilitary groups. Interestingly enough, my data provides a third party that is also responsible for violent deaths, the public force.[6] Therefore, my research will add to Angrist & Kuglar (2008)'s analysis on coca production and violent death rates.

Ibanez and Martinsson (2013) publish another study that analyzes the curbing of coca cultivation in Putumayo, Colombia. In this study they analyze the effectiveness of eradication policies based on the farmer's behavioral response to anti-drug policies. They primarily focus on the farmer's moral cost of producing coca, hence the moral cost involved is environmental damages and levels of violence due to coca production (Ibanez & Martinsson, 2013). A framed field experiment is utilized to measure the participants' behavior. They provided each participant ten points that represent land, labor, and capital. They were then given nine different government policy scenarios, in which they needed to allocate their resources effectively in order to cultivate either coca or cattle. Their results demonstrate that only 26 percent of their participants considered the moral cost of coca production when making their investment decisions. Thus, Ibanez and Martinsson (2013) suggested that increasing the public's awareness of the moral cost associated with coca cultivation would create an effective policy to reduce coca

[6] Public forces include the national police, military, navy, etc. see appendix 3 and 4.

production. Again, Ibanez and Martinsson (2013) fail to acknowledge coffee bean production as the alternative option and instead suggest cattle as the alternative, but do not explain why.

Based on Holmes et al. (2006)'s, Angrist and Kugler (2008)'s, and Ibanez and Martinsson (2013)'s arguments I assume that coca leaf production and eradication fluctuate the level of crime rates reported in the different departments of Colombia. If there is an increase in coca leaf production, then the alternative substitute crop coffee beans is negatively impacted. Garcia- Yi (2014), amongst other authors, suggest that a solution to Colombia coca cultivation problem, should be to promote an alternative method that is a labor intensive item of export, in order to decrease coca cultivation instead of forcing eradication and alleviating violence. The purpose of my paper is to demonstrate that the ideal alternative production is indeed coffee beans.

C. Coffee Bean-Crime Rate

In the past two sections I looked at the two relationships between coffee bean cultivation and coca leaf cultivation, and the connection between coca leaf productions and levels of crime rate. In this final section of the literature review, I will establish the overall connection between coffee bean production and the levels of crime. There is limited research on the connection of these two concepts, but the following articles provide an academic overview of this relationship.

Coffee bean cultivation and levels of crime are two unique characteristics to Colombia. Since the 1940's, Colombia has been plagued with civil conflict because of the outbreak between the Liberal and Conservative political parties. Yet, the impact of armed conflict on coffee bean cultivation has become more prominent in the last twenty years. In a case study done in Colombia, Munoz-Mora (2010) states that armed conflict in 1985 was hardly present in the coffee growing regions. Ten years later, armed conflict was present in 58 percent of coffee

growing regions of Colombia (Muñoz-Mora, 2010). The presence of armed conflict in these regions have demonstrated inefficiency and hindrance on economic growth for coffee farmers (Muñoz-Mora, 2010). Abruption of violence has plagued many poor farmers, and many of them are forced to leave their farms and start a new beginning in the nearest city (Holmes et al., 2006).

Munoz-Mora (2010) case study, originally written in Spanish, seeks to identify the impact of violence on coffee bean production and its farming efficiency. As the presence of armed organization increased in coffee growing regions, farmers tended to diversify their sources of income and many of them resorted to cultivating coca leaves (Muñoz-Mora, 2010). In this case study the author utilizes a stochastic production function: a model that analyzes the inefficiency of coffee farmers in correlation to the violence rates in different Colombian regions. The first significant observation that he makes, and contributes to my research, is the increasing numbers of violent attacks in coffee growing regions. In these same regions there is also a presence of coca cultivation. Through a series of graphs, he locates the regions that contain all three overlapping characteristics. In his stochastic production function, he controlled a series of variables that lead to his establishment that the presence of violent attacks in coffee growing regions significantly reduced coffee production by 1.2 percent, in comparison to other coffee growing regions without violence. The stochastic production function, also known as the Stochastic frontier analysis, is a model for technical efficiency that are assumed to be a function of a firm-specific variables and time.[7] The observable efficient variables will follow the frontier and the inefficient variables are located within the frontier. Thus, he analyzes the efficiency of coffee farming efficiency in relation to the variables of Colombia's FedCafe and violence rates. FedCafe is present in various locations throughout Colombia, and its presence resulted in

[7] Stochastic Frontier Models and Efficiency Analysis, n.d.

positive impact on coffee production during the civil unrest (Muñoz-Mora, 2010). Overall, this paper establishes a connection between violence rate in Colombia and its negative impact on coffee bean production. This paper demonstrated that violence rates affected coffee bean production, contrary to my hypothesis. The following article discusses the same relationship but utilizes international coffee prices as an indicator for crime rate.

Rettberg (2010) discusses that violence in Colombia's coffee growing regions is due to the disruption in the International Coffee Agreement in 1989. She calls this disruption in prices as the "Coffee Crisis," that essentially diminished the price of coffee beans and led to an up rise of coffee farmers (Rettberg, 2010). The International Coffee Organization (ICO), in collaboration with FedCafe, failed to establish an international coffee price after the period of La Violencia in the 1950's (Rettberg, 2010). Rettberg (2010) discusses that the overall price shock on coffee led farmers to cultivate the substitute crop, coca. Armed organizations had the advantage in gaining access to the coffee growing farms because of Colombia's weak agricultural economy (Rettberg, 2010).

It is reasonable that a weak state led armed groups to invade coffee bean farms, but I do not necessarily agree with how she positions the relationship of crime as an indicator for coffee growth. From the coca crop literature, Angrist and Kuglar (2008) and Holmes et al. (2006) state that the cultivation of coca is the root of violent deaths. Since coffee beans and coca leafs are substitute crops, it makes sense that the cultivation of either crop influences the violence associated with armed groups. Thus, the following article by Dube and Varga (2006) analyzes violent attacks contingent to coffee bean prices, coffee bean, and coca crop cultivation in Colombia.

An extension of Rettberg (2010)'s discussion and Angrist and Kuglar (2008)'s resource curse, Dube and Varga (2006) examine what they call a resource curse in reverse by stating that the exogenous coffee price shock influenced the violence rates in Colombia. They utilize a fixed effect difference-in-difference model that analyzes the level of violence in coffee growing and non-coffee growing regions before and after this "Coffee Crisis" (Dube & Varga, 2006). They aggregate data for coffee prices, coffee growing departments, hectares dedicated for coffee cultivation, hectares dedicated to coca cultivation, and poverty rates. Based on these variables, their results show that average guerilla attacks in coffee-growing regions are about 0.55 and in non-coffee growing regions they are about 0.47. However, for the purpose of this paper I will only focus on the results affecting coffee growing regions. Post coffee crisis, the number of attacks increased by 0.21 more than before, per municipality (Dube & Varga, 2006). This increase is considered statistically significant at the one percent level. Ultimately, they conclude that stabilizing the price of a primary commodity can influence violence rates in Colombia. Additionally, they claim that institutions such as the ICO and FedCafe can strategically reduce the level of violence if they can adequately compensate for an unexpected coffee crisis (Dube & Varga, 2006).

Dube and Varga (2006)'s research provided an intriguing discussion of coffee bean and coca crop hectares of cultivation on the level of crime rate. This is important for my paper because it provides an avenue for me to continue the research on the relationship between coffee bean production and the type of crime I want to highlight. My added contribution to the existing literature is to analyze two types of homicide rates, massacres and selective assassinations, which are two separate responses towards coca eradication exertions from the government. Furthermore, I want to shed light on how coffee bean and coca leaves hectares of cultivation

influence massacres and assassinations after the years 2000. Most of the literature discussed, focuses on information before the 2000's, or they look at only one year, so I will be using a panel dataset that looks at multiple departments across various years. In the following methodology section, I will discuss in the detail my data, analysis, and results.

IV. Methodology

Dube and Varga (2006) utilize a fixed effect difference-in-difference model to analyze coffee production and political violence over time within a given municipality and they consider the years 1998-2004. I will be analyzing the years 2002-2010, given the limited data on coffee bean production per department. This paper will be an approximate to Dube and Varga (2006)'s analysis of coffee bean production and armed conflict, but it will primarily focus on the specific types of homicides that result of political violence in Colombia. I will also be utilizing a fixed effects model on six Colombian departments that have overlapping events of homicide events, coffee bean cultivation, and coca crop cultivation. The purpose of this section is determine whether or not coffee bean cultivation area has an effect on massacres and assassinations reported.

A. Sources of Data

I merged the following datasets: coffee bean hectares, coca leaf hectares, massacres, and assassinations. I acquired the coffee bean data from FedCafe, because it provides the total hectares of land dedicated to coffee beans from 2002-2014.[8] The data provided by FedCafe is mainly in Spanish, so I translated the department's name and headers of the file. Colombia has a total of 32 departments, 22 of those departments cultivate coffee beans, and 16 have available

[8] 1 Hectare = 2.47 acres of land

coffee bean production data. The total number of coffee producing departments demonstrates the vitality of this industry to Colombia's overall agricultural economy. From the list of the coffee producing departments, I only selected six departments that dedicated the largest hectares of land to cultivate coffee beans: Antioquia, Caldas, Cauca, Huila, Tolima, and Cauca Valley (see appendix 1). These six departments are located in the Andean and Pacific region of the country.[9]

I collected the coca crop data from the database from Empirical Studies of Conflict (ESOC), they gather a series of public surveys in order to gain a better understanding of Colombia's civil conflict. The coca leaf data also measures the total hectares of land dedicated to growing coca leaves, based on aerial survey and ground inspections. Since the Colombian government has deemed the coca crop as an illicit product, farmers are more cautious of growing coca, thus coca crop data is difficult to collect. Ibanez & Carlsson (2010) state that farmers are willing to take a risk for higher profits by cultivating their coca crops with other crops in order to avoid detection. The coca leaf data was available on municipality level, so I identified every municipality to its corresponding department and group each of them by their respective year. A total of 23 departments had a record of growing coca leaves within the time range 2001-2010. Of these departments, I selected those departments that overlap with the six coffee cultivating departments. However, only four had records of coca crops: Antioquia, Caldas, Cauca, and Cauca Valley. Huila and Tolima did not have any record of producing coca, but they did have a record of crimes. Unlike Holmes et al. (2006) who analyzes the four departments with the highest cultivation of coca leaves, I analyze the four departments that overlap with the departments with the highest coffee bean cultivation area. The reason for doing this, is to identify

[9] Refer to appendix 2, to see a visual of the departments.

whether or not coffee bean production has a significant effect on the crimes committed in these six departments.

The same six coffee-growing departments also face a series of crimes; however, the two types of crime I have chosen for this study are massacres and selective assassinations. I acquired the two data sets through the database Basta Ya.[10] Basta Ya, Spanish for "Enough Already", is a unique database that collects news reports that record infliction of violence on the Colombian population from 1980-2012. In each file, the authors include information such as location of the event, the parties involved, the number of victims, and the news source. This database is also in Spanish, so I translated the given information and description of events. As previously stated, I want to research the crime data in detail, specifically death. Death is one the main results of the violent conflict between the guerilla, the paramilitary, and government (Holmes et al., 2006). Whether death occurs in a rural or urban area, death brings economic hardship to any community (Angrist & Kuglar, 2008).

According to Basta Ya, massacres is defined as the murder of four or more defenseless people through public display, in order to perpetuate fear amongst the public by armed groups. Meanwhile, selective assassinations are defined as the murder of three or less defenseless people, also a result of the civil conflict. Both datasets mention the type of armed group involved with the incident; therefore, I categorized each crime in accordance to the parties involved, if available. Each crime has been filtered through the years 2002-2012, and by the six departments. For massacres, the predominant groups involved with the incidences are the paramilitary groups, guerrilla organization FARC, and the public force (see appendix 3). Meanwhile, the predominant

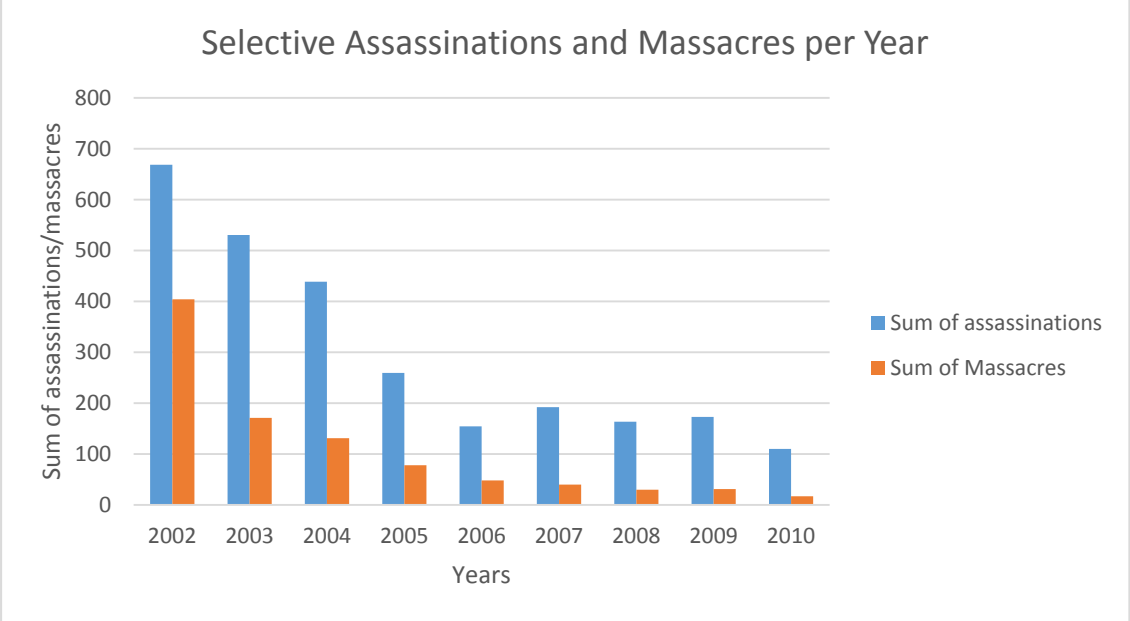
[10] Centro Nacional de Memoria Histórica (2012)

groups involved with assassinations are non-identified paramilitary groups, guerilla organization FARC, and the national army, and under each group there are sub-parties that have specific titles (see appendix 4).

B. Descriptive statistics

The following graph show the sum of both selective assassinations and massacres over 8 years. According to Graph 1, selective assassinations is greater in comparison to the sum massacres. This is intriguing because selective assassinations account for the death of 3 people or less, while massacres accounts for the death of 4 people or more. This demonstrates that overall selective assassinations occur more often than massacres over the 8 years.

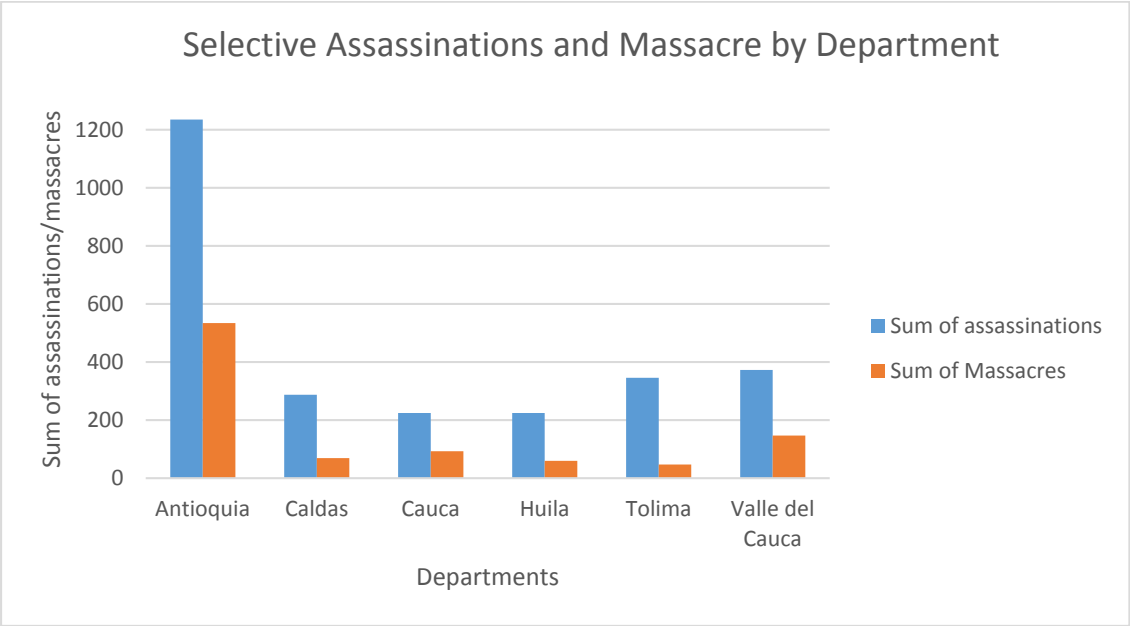
Graph 1



In Graph 2, we see both types of homicide in accordance to the six departments, and one can see that it follows a similar trend to the Graph 1. The sum of assassination continues to be predominant in the six departments. Furthermore, an interesting figure is the concentration of

homicides in Antioquia compared to the rest of the departments. This is due to the size of the department. Antioquia is larger thus it inhabits a greater population.

Graph 2



It is interesting to note that in Graph 1, there is a decreasing trend in the total number of homicides reported over the years. This decrease can be explained by Graph 3. There is an inverse relationship between coffee bean hectares of cultivation and the sum of massacres and selective assassinations over the 8-year time frame.[11] The decrease in homicides can also be explained by other factors, such as the election of a new president, Alvaro Uribe. Throughout his presidency, there have been many "peace" talks between the armed groups and government officials, but nothing definitive to end the conflict completely. In 2007, there is a series of hostage situations that take place between FARC and the Colombian government.[12] These hostage situations mainly affected government officials and political ties with neighboring countries. Meanwhile in the coffee bean industry, after the 2000's there is stabilization in the

[11] On the right side of the graph, the secondary axis accounts for the sum for hectares of land
[12] Key Events in Colombia, n.d.

international coffee bean prices after the "Coffee Crisis" that occurred during the 90's. Thus, according to the World Bank (2003) report, there is a strong effort to promote the growth of coffee bean trees throughout the country. Furthermore, it is also important to recognize that the size of a department maybe skewing the total sum of massacres and selective assassinations, such as Antioquia. Many events can account for the trends that appear in Graph 3, yet through my regression analysis the trends can be explained.

Graph 3

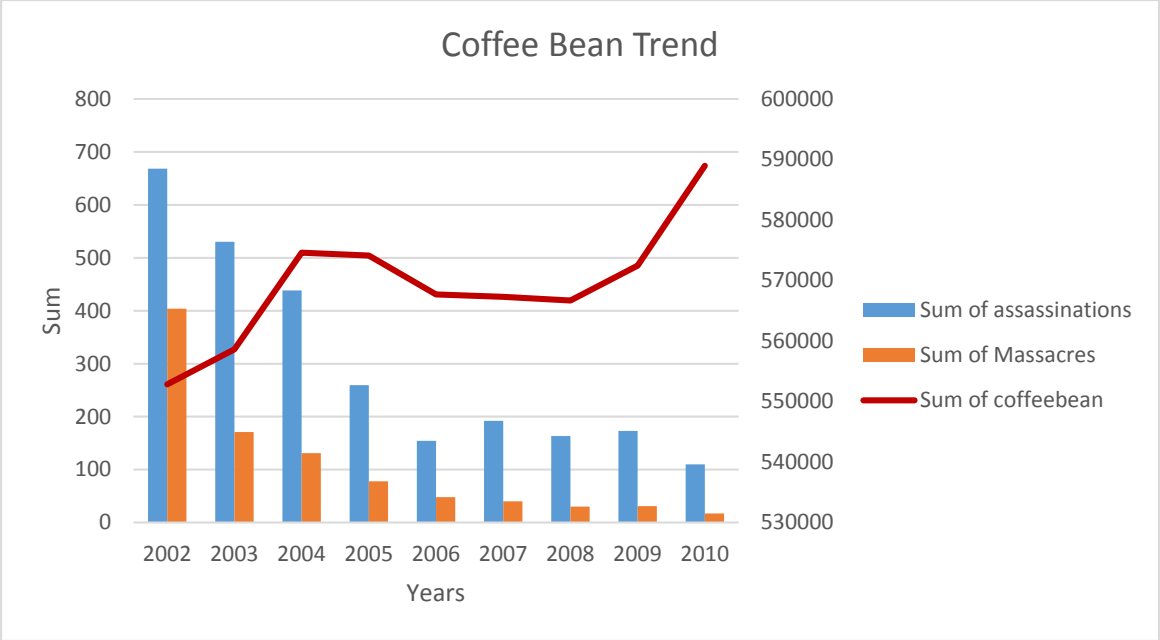


Table 1 is the summary statistics of the four variables I am analyzing. One can see that coffee bean hectares of cultivation is indeed greater then coca leaf hectares. The largest hectares cultivated in a given year was 154,983 hectares, and the minimum was 65,681 hectares which shows that Colombia dedicates large amounts of land to the production of this crop. Additionally, the maximum hectares of coca cultivated was 8,157 hectares, which is rather a large amount of land, but small in comparison to coffee cultivation.

The max number of massacres for a given municipality and year is 24. It is evident that mass murder perpetuates fear among any community that is why it is important to analyze what triggers such events. The average number of selective assassinations between 2002 and 2012 is 1.39 deaths. The average selective assassinations should be less than 1.39, because according to the database selective assassinations range from 1-3 individuals murdered, and in Table 1 the max number of assassinations are 5 individuals. Thus, the highest number of individuals murdered should be 3 and not 5.

Table 1

Variable	Mean	Std. Dev.	Min	Max
Coffee Bean	97840.52	23247.9	65681.16	154982.9
Coca	2406.38	2526.71	0	8157
Massacres	5.3	2.46	4	24
Assassinations	1.39	.66	1	5

C. Models

I use an Ordinary Least Squares (OLS) regression model to analyze my data. Based on the literature of coffee bean production in relation to coca leaf production for model 1, I hypothesize that an increase in $\gamma_1 Coffeebean$ will decrease the number of deaths for $Massacres$ present in the six departments. I assume that the land available to cultivate coca crops, will be used to cultivate coffee beans instead, thus decreasing the affiliation to armed organizations and overall reducing homicides. Meanwhile, an increase in $\gamma_2 Coca$ production will increase $Massacres$ because farmers will become affiliated with armed group operations, thus increasing the probability of being murder. For model 2, I hypothesize that $\rho_1 Coffeebean$ will also decrease the number of deaths for $SelectiveAssassinations$, while an increase in $\rho_2 Coca$ will increase $SelectiveAssassinations$. The setup of my model is as follows.

OLS Model

Model 1:

$$Massacres = \gamma_0 + \gamma_1 Coffeebean + \gamma_2 Coca + \delta$$

Model 2:

$$SelectiveAssassinations = \rho_0 + \rho_1 Coffeebean + \rho_2 Coca + \sigma$$

Where:

1) $Massacres$ = dependent variable for model 1; measured in the number of individual deaths
2) $SelectiveAssassinations$ = dependent variable for model 2; measured in the number of individual deaths
3) $Coffeebean$ = independent variable; measured in hectares of land used to cultivate coffee beans
4) $Coca$ = independent variable; measured in hectares of land used to cultivate coca leaves
5) δ and σ = the error term in model 1 and 2

Table 2

VARIABLES	(1) Massacres	(2) assassinations
coffeebean	0.00119**	0.00216***
	(0.000510)	(0.000474)
coca	-0.00547	-0.00270
	(0.00474)	(0.00427)
Constant	-70.02	-133.5***
	(43.02)	(40.09)
Observations	28	36
R-squared	0.185	0.435

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

Table 2 demonstrates the following results for model 1, holding all else constant, a one-hectare increase of $\gamma_1 Coffeebean$ will increase $Massacres$ by 0.00119 and it is significant at the 5% alpha level. Meanwhile, holding all else constant, a one-hectare increase in $\gamma_2 Coca$ will decrease $Massacres$ by 0.00547, but it is not significant. In model 2, holding all else constant, a one-hectare increase in $\rho_1 Coffeebean$, will increase $SelectiveAssassinations$ by 0.00216, and it is significant at the 1% alpha level. A one-hectare increase in $\rho_2 Coca$ will decrease $SelectiveAssassinations$ by 0.0027, but again it is not significant at any alpha level.

According to the OLS results, there is a positive correlation between coffee bean production and massacre and assassinations, meaning that crime will continue to increase if hectares of coffee bean increases. If coffee bean production increased by 1,000 hectares of cultivation, massacres would increase by 1.19 deaths, and selective assassinations would increase by 2.16 deaths. The increase in death is less than the average for both massacres and selective assassination so the increase it not relatively high. Therefore, the OLS model may not be the best measure for analyzing the relationship between coffee bean cultivation and homicides.

Limitations of OLS Model

The OLS model does not take into account the differences in population size for each department. For instance, Antioquia is relatively larger in population size in comparison to the other departments, thus there are more victims of crime. Acquiring population data to control for this was difficult to obtain. Colombia's census data does not provide consecutive annual data on population for each department; therefore, I could not include population as a control variable in my regression analysis (see appendix 5). Climate is also another variable that I intended to control; however, the Institute of Hydrology, Meteorology, and Environmental Studies (IDEAM) only provides monthly averages for the time frame 1981-2010 (see appendix 6). Therefore, it is

difficult to match the rainfall to the given years 2002-2012. Because I lack the necessary data that would control for these variables, I utilize a fixed effect model in order to control for observable and unobservable variations.

Fixed Effects Models

The fixed effects model controls for the variation within department and year, hence the next two models hold different results in comparison to the OLS models. For model 3, I also hypothesize that an increase in $\alpha_1 Coffeebean_{it}$ will decrease the number of deaths for $Massacres_{it}$. Meanwhile, an increase in $\alpha_2 Coca_{it}$ production will increase the number of deaths for $Massacres_{it}$. In model 4, I hypothesize that $\beta_1 Coffeebean_{it}$ will decrease the number of deaths for $SelectiveAssassinations_{it}$, while an increase in $\beta_2 Coca_{it}$ will increase $SelectiveAssassinations_{it}$.

Model 3:

$$Massacres_{it} = \alpha_0 + \alpha_1 Coffeebean_{it} + \alpha_2 Coca_{it} + \delta_i + \alpha_t + \varepsilon_{it}$$

Model 4:

$$SelectiveAssassinations_{it} = \beta_0 + \beta_1 Coffeebean_{it} + \beta_2 Coca_{it} + \rho_i + \sigma_t + \mu_{it}$$

Where:

1. Subscript $_i$ = variation within department (state)
2. Subscript $_t$ = variation in time
3. $Massacres_{it}$ = dependent variable for model 3; measures the number of individual deaths with control for variation within department and year
4. $SelectiveAssassinations_{it}$ = dependent variable for model 4; measures the number of individual deaths with control for variation within department and year

5. $Coffeebean_{it}$ = independent variable; measured in hectares with control for variation within department and year
6. $Coca_{it}$ = independent variable; measured in hectares with control for variation within department and year
7. δ_i and ρ_i = captures variation within department
8. α_t and σ_t = captures variation within time, dummy variable represents years 2002-2010
9. ε_{it} and μ_{it} = the error term in model 3 and 4

Table 3

VARIABLES	(3) Massacres	(4) assassinations
coffeebean	-0.00322	0.000324
	(0.00460)	(0.00278)
coca	-0.0140	-0.00311
	(0.00940)	(0.00847)
Observations	28	36
R-squared	0.566	0.546
Number of Dept	4	4

Standard errors in parentheses
*** p<0.01, ** p<0.05, * p<0.1

The results in the fixed effect model indicate that coffee bean cultivation does not have any significant effect on the homicidal rates in Colombia. Table 3 demonstrates that after controlling for all 8 years, there is no significance amongst any independent variable.[13] In model 3, a one-thousand-hectare increase of coffee beans will decrease massacres by 3.22 deaths and an increase in a one-thousand-hectare of coca cultivation will also decrease massacres by 14 deaths, but neither variable is significant. In model 4, a one-thousand-hectare increase in coffee bean

[13] See appendix 7 for a full view of the table with the dummy variables

will increase selective assassinations by 0.324 of a death, while a one-thousand-hectare increase in coca cultivation will decrease selective assassinations by 3.11 deaths, yet no significance. The numbers seem to take a wide range when both crops increase, since the average number of massacres are 5.3 deaths and the average selective assassinations are 1.39 deaths.

Overall, the results show that there is no correlation between coffee beans and massacres, and coffee beans and selective assassinations. Furthermore, there is no correlation between coca crops and massacres, and coca crops and selective assassinations. An explanation for the non-significance between the independent and dependent coefficients is explained in the variation within each year. Within each year there are contributing factors that influence the fluctuation of homicides per department. The baseline for the regression is 2002, and as the years progress there is a significant decrease of massacres and selective assassinations. One of those factors could be the introduction of the new president Alvaro Uribe to the country in 2002. President Alvaro may have had political influence on massacres and selective assassinations throughout the 8 years, thus decreasing the homicide rate.

Another possible explanation for the non-significance maybe due to variation in the sample size of the variables. Therefore, I take the log of the coffee bean and coca leaf variables and conduct another regression (see appendix 9). In this regression, the results for both logged variables have almost the same results as the regressions for model 3 and 4, except for log of coca and selective assassinations. Again, these results are not significant meaning that there is no correlation between coffee beans, coca leafs, and the two types of homicides.

The overall correlation between coffee bean and coca leaf is 0.537, positive and a rather strong correlation. Because these two crops are strongly correlated, I conducted two more regressions separate from each other (see appendix 11-13). Once again there is no significance

between coffee beans, coca leafs, and the two homicides. However, the dummy variables have a significant correlation to massacres and selective assassinations. The baseline year of analysis is 2002 and as dummy years progress, massacres and selective assassinations significantly decrease. Therefore, this indicates that the decrease in homicides is linked to the variation in each year and not coffee bean cultivation, as stated previously.

Dube and Varga (2006)'s analysis of coffee bean production and armed conflict demonstrate that a higher value of coffee beans in the international market decreases violent conflict, but a decrease in the international price of coffee bean triggers violence in Colombia. They analyze the price of coffee bean production and not simply the hectares of cultivation. Their overall results suggest that coffee bean production decreases violence rates, a result similar to model 3 where coffee bean production decreases massacres but not selective assassinations, if it were statistically significant. Dube and Varga (2006)'s analysis of coca crop as a substitute crop fails to explain the increase and decrease of violence rates in Colombia. My results for model 3 and 4 also fail to explain the decrease in homicides when coca cultivations of hectares increase since there is no significance between the two variables.

Limitations

Overall, coffee bean production does not have a significant effect on the homicide rate in the six Colombian departments. The model I used in this paper is a simple one due to the difficulty in obtaining the necessary data from the Colombian department of statistics. If given additional data, the model can be further expanded to provide an analysis of other contributing factors to homicides in Colombia. Such factors include coffee bean prices per department, coca crop prices per department if available, and controlling for weather in each department. Additionally, one could either expand the number of departments observed or potentially look at

the violence rate in non-coffee growing departments. An inclusion of these variables would further explain the relationship between coffee bean production and crime rate in Colombia.

Analyzing municipality-level data may provide a better understanding of how coffee bean cultivation affects each municipality involved with the production, because some municipalities may heavily rely on the product while others may not. The terrain varies throughout the country thus select municipalities may have an advantage over the production, while other municipalities may focus on a different product. It would also help to focus on one coffee-growing municipality per department instead of look at a whole department, because some departments vary in size, therefore skewing the number of observations in the dataset. Hence, municipality-level analysis can have different results in comparison to the departmental-level analysis.

V. Conclusion

The purpose of this paper was to determine whether coffee bean cultivation has a significant effect on crime rate in Colombia. After utilizing a series of fixed effect regression models, the results indicate that coffee bean production did not have a significant effect on either massacres or selective assassinations. Aggregate departmental data indicate that other factors influence the level of homicides across the years 2002-2010, and coffee bean production does not solely affect departmental homicides. Coffee bean crops seem like the ideal alternative method of cultivation, because for one it is the substitute crop for coca leaves, secondly it already has an established presence in Colombia's agricultural economy, and lastly the organization of Colombian Coffee Bean Growers Federation financially supports small scale farmers who grow traditional coffee.

Future of Coffee Bean Production

A potential avenue to research is the upcoming trend of fair trade coffee in Latin America. Colombia is one of the largest producers of coffee, so the introduction of organic coffee beans can potentially provide farmers bargaining power to maximize their profits and lessen the cultivation of coca leaves. Fair-trade coffee beans can add to the supply of traditional coffee beans and further strengthen Colombia's agricultural economy. Garcia-Yi (2012) analyzes the production of organic coffee been in Peru, and demonstrates that farmers are more willingly to cultivate organic coffee beans over coca leaves. Thus, organic coffee beans can potentially serve as an alternative development crop.

Case Study - Guatemala

As mentioned in the literature review, Garcia-Yi (2014)'s and Ibanez and Carlsson (2010)'s research indicate that farmers are more responsive to profit maximizing crops. This past spring break, I had the opportunity to tour a local organic coffee farm in San Miguel Escobar, Guatemala. This local farm is supported through a cooperative called As Green As It Gets, an organization that funds sustainable economic development and organic coffee trade (History, n.d.). A family of eight cultivated an organic coffee farm on a volcano slope, and I had the opportunity to ask the two brothers, who were our tour guides, a few questions in regards to their farm's production. I first asked why they cultivated large hectares of coffee bean, as opposed to other crops, and they answered that they would cultivate any crop that was marketable and provided high revenues. Previous to the coffee farm, they had cultivated beans and yucca roots,[14] so they cleared their lands to cultivate organic coffee beans and meet the

[14] A type of potato common in Latin America

current demand. Like the farmers surveyed in Garcia-Yi (2012)'s and Ibanez and Carlsson (2010)'s research, these farmers were motivated through economic incentives, despite if the product was an illicit crop. I followed up by asking them whether or not they would cultivate coca leaves despite its negative attributes, and they responded by stating that if there was a local market and demand for coca leaves, they would also cultivate it on their farm without a doubt. Again demonstrating that famers react to profit incentives, more so if they have an organization that supports their production.

Policy Implications: Plan Colombia

Many authors, politicians, and activists debate that a more efficient alternative development program, one better than Plan Colombia, is necessary to halt the cultivation of coca leaves and diminish the level of crime (Holmes et al., 2006). A segment of Plan Colombia requires manual eradication of crops throughout the Colombia terrain, which can be difficult because most of the production derives from mountain slopes and high altitudes of 4.900 feet in elevation.[15] As a result, Colombian officials encourage farmers to cultivate alternative crops such as bananas and cacao, yet the production of these products are not as profitable, and transportation for the harvest can be difficult in mountainous terrain (Miroff, 2015). The effectiveness of this policy is constantly debated because of its unsuccessful rates and lack of peace between Colombian government and armed groups in negotiating treaties. Colombia is made up of complex terrains and this is a natural barrier that keeps the country from uniting. Communities lack communication from one another. Thus, in order for a policy such as Plan Colombia to be successful, the policy should appeal to the smaller communities based on their

[15] Coca Cultivation and Cocaine Processing. (2005); Miroff, (2015)

local economies. Eradicating coca leaf crops will not resolve the armed conflict in Colombia, but if the United States invested that military aid to reduce the addiction of cocaine in their country, then it would reduce the demand for cocaine. As a result, it would reduce the supply coca leaves cultivated in Latin American countries.

Overall, it seems that farmers are motivated through different economic incentives, so recommending one solution to Colombia's violence-stricken economy seems almost impossible to obtain. Since coca leafs originate from rural locations, studying Colombian farmer's behavior can provide a better understanding of their local economies and personal choices. For this reason, it is important for scholars to continue studying the different methods and approaches that can potentially decrease the violence in Colombia, and provide a safety net for farmers who are vulnerable to the armed conflict. Through academic literature, policy officials can identify the best methods that could alleviate Colombia's civil conflict.

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